NTSB National Transportation Safety Board

Office of Highway Safety

Boston, Massachusetts

July 10, 2006

Topics

- Central/Artery Tunnel project
- Agencies and companies involved in ceiling design and construction

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Central Artery/Tunnel Project

- Improve traffic flow through Boston
- Central Artery (I-93) opened in 1959 with a design capacity of 75,000 vehicles per day
- Traffic capacity later exceeded 190,000 vehicles per day
- Other improvements included the expansion of Interstate 90

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EXIT 26
Storrow Dr.
Cambridge
¼ MILE
EXIT 25
Causeway St.
N St tion
FENWAY
PARK
EXIT 24
SPEED
LIMIT
35

Central Artery Statistics

- 161 lane miles along a 7 ½ mile corridor
- Five miles of tunnels
- Six highway interchanges
- 200 bridges
- Originally scheduled for completion in 1998 at a cost of $2.6 billion
- Major construction completed in 2006
- Final cost exceeding $14 billion

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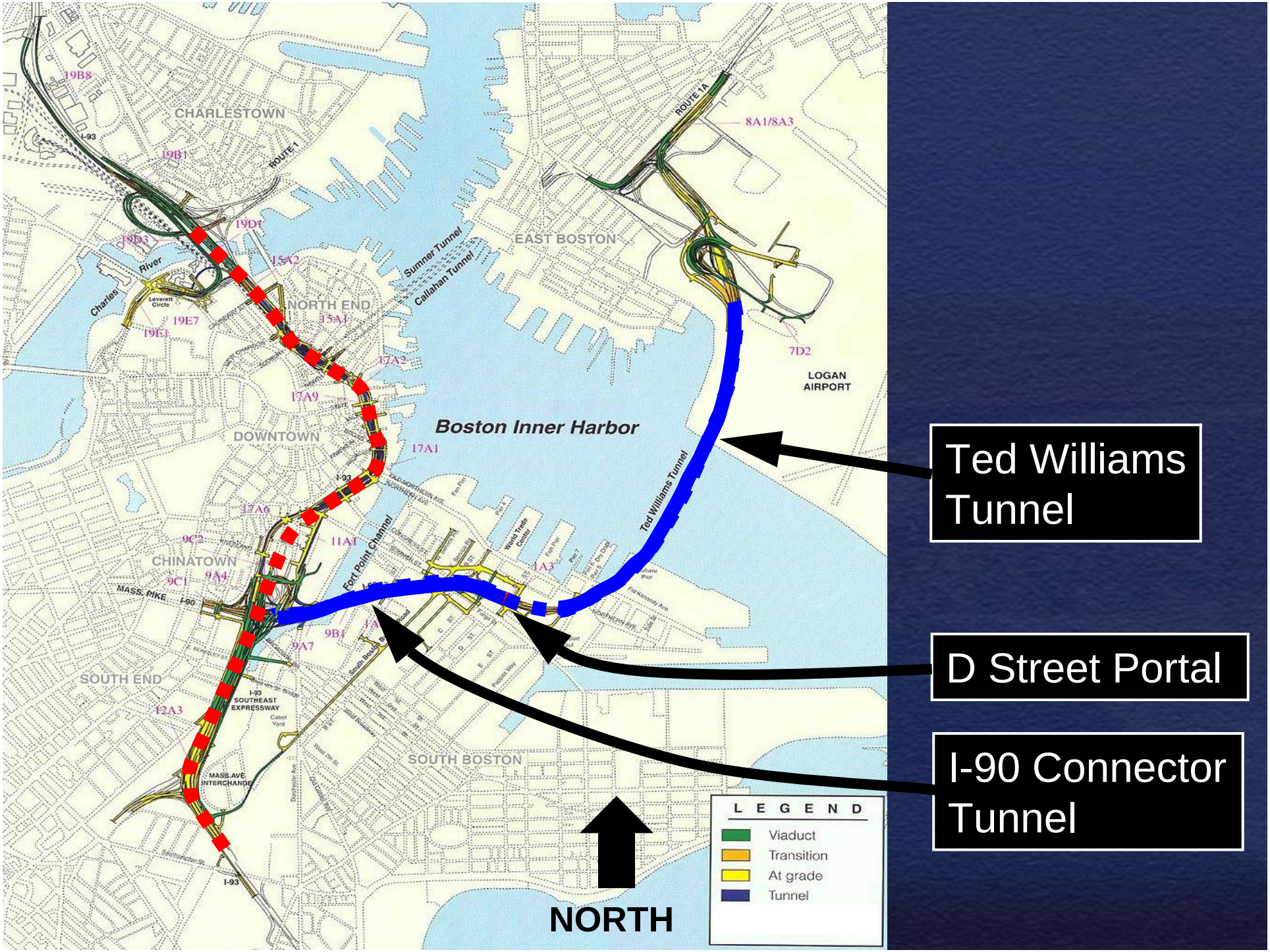


Ted Williams Tunnel

D Street Portal

I-90 Connector Tunnel

Construction Sequence

Ted Williams
Tunnel portal

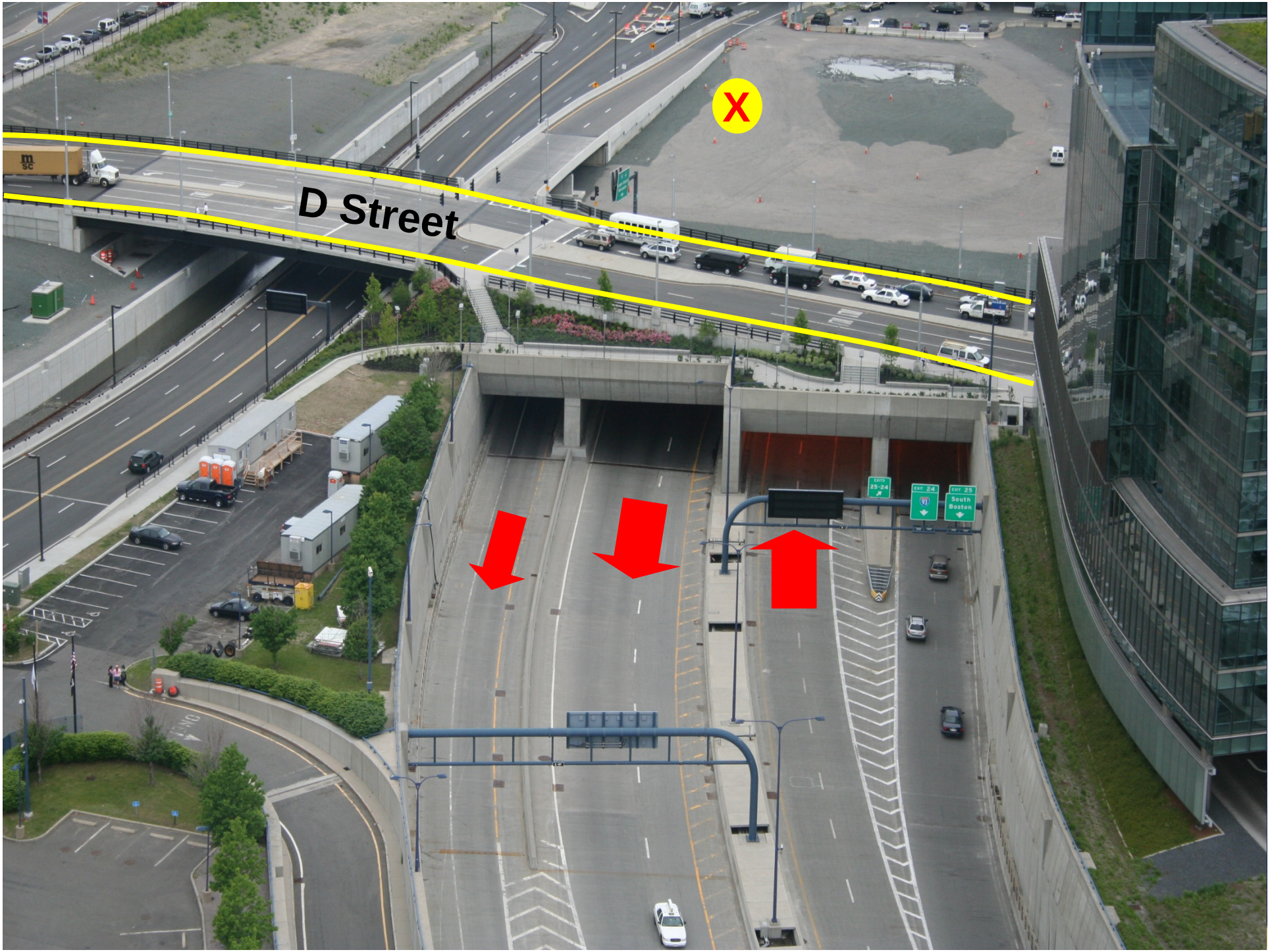
D Street portal

Construction Sequence

Ted Williams
Tunnel portal

Temporary
access ramp

D Street


D Street
X
EXIT 25-24
EXIT 24
91
EXIT 25
South Boston

Source: Mass. State Police

Ceiling Design Sequence

- Construction on the Ted Williams Tunnel began in 1991
- Ceiling system for the Ted Williams Tunnel designed in 1992
- D Street portal completed in 1993
- Ted Williams Tunnel opened in 1995

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Suspended ceiling
Source: Mass. Turnpike Authority

Problems Encountered

- Installation of the ceiling was expensive and complicated
- Custom panels were time consuming to install
- Panels were expensive to maintain

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Ceiling Designs

- Federal Highway Administration initiated a study in February 1995 to examine alternative ceiling designs
- New design to be used in both the I-93 and I-90 tunnels
- New ceiling design adopted in June 1995
- New design was less expensive and easier to install

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Ceiling Design Sequence

- New design completed in 1996 and first used for the I-93 tunnel
- I-93 tunnel used steel roof girders to support the ceiling hardware
- The 1997 tunnel finishes contract for the I-90 tunnel required the new design
- Remainder of I-90 tunnel constructed with embedded steel channels to support the ceiling hardware

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Source: Mass. State Police


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Source: Mass. State Police

Issues

- Insufficient understanding among designers and builders of the nature of adhesive anchoring systems
- Lack of standards for the testing of adhesive anchors in sustained tensile-load applications
- Inadequate regulatory requirements for tunnel inspections
- Lack of national standards for the design of tunnel finishes

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Investigation Participants

- Massachusetts State Police
- National Institute of Standards and Technology
- Federal Highway Administration
- Turner-Fairbank Highway Research Center

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